Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

0123456789

COMBINED SCIENCE **0653/03**

Paper 3 Theory (Core) **For Examination from 2019**

SPECIMEN PAPER

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
A copy of the Periodic Table is printed on page 20.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **20** printed pages.

CAMBRIDGE International Examinations

1 **(a)** Fig. 1.1 is a diagram of the internal structure of the heart.

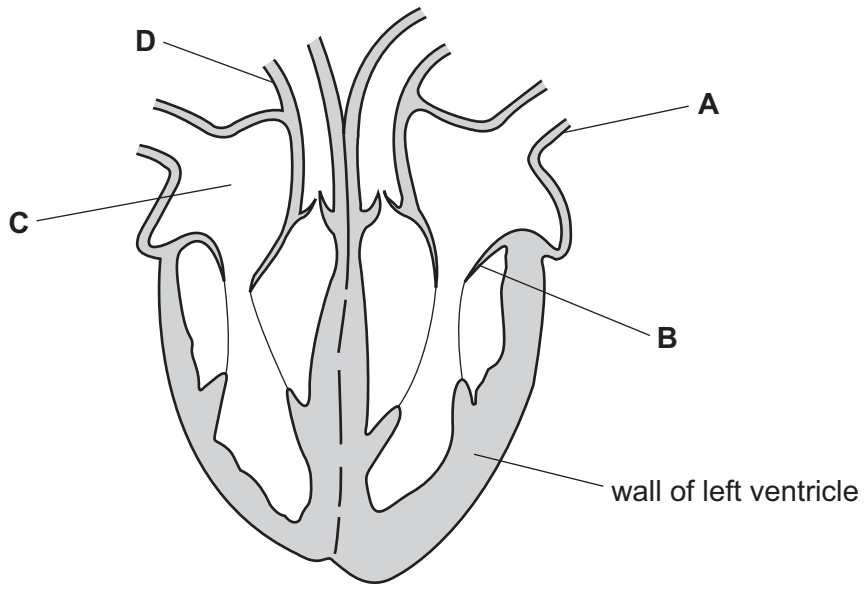


Fig. 1.1

(i) Use the following words or phrases to name structures **B** and **C**.

aorta **coronary artery** **one-way valve**

pulmonary artery **pulmonary vein** **right atrium**

right ventricle **septum** **vena cava**

B .....

C .....

[2]

(ii) On Fig. 1.1, draw two arrows to show

1. the direction of blood flow through **A**,

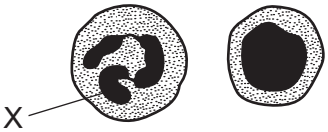
2. the direction of blood flow through **D**.

[2]

(b) (i) Table 1.1 shows diagrams of some blood cells.

Complete the table.

Table 1.1

diagram	name of cells	function of cells
	.....	....
	.....	....

[4]

(ii) Describe the function of structure **X** in the cell shown in Table 1.1.

.....

..... [1]

[Total: 9]

2 **(a)** An atom of carbon has a proton (atomic) number of 6 and a nucleon (mass) number of 12.

(i) Complete Table 2.1 to show the structure of this carbon atom.

Table 2.1

	in nucleus	outside nucleus
number of protons	6	0
number of neutrons	.....	.....
number of electrons	.....	.....

[2]

(ii) The protons in a carbon atom have a positive charge.

Explain why a carbon atom has no overall charge.

.....

.....

..... [2]

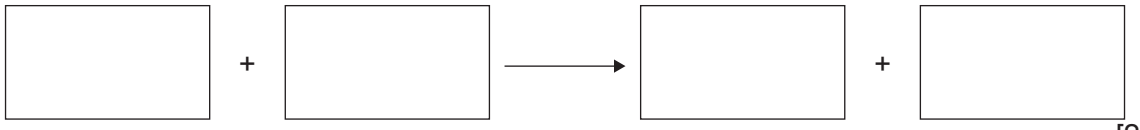
(b) Methane is a hydrocarbon and the main constituent of natural gas.

(i) Natural gas is a fossil fuel.

Name two other fossil fuels.

..... and ..... [1]

(ii) Write a **word** equation for the complete combustion of methane.



[2]

(c) Fig. 2.1 shows the structure of a molecule of methane.

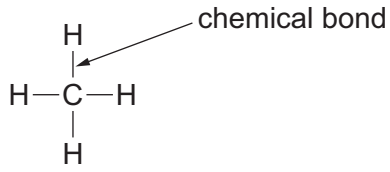


Fig. 2.1

(i) State the formula of methane.

..... [1]

(ii) Name the type of chemical bond in a methane molecule.

..... [1]

(iii) State the number of electrons in the chemical bond shown in Fig. 2.1.

..... [1]

[Total: 10]

3 Fig. 3.1 shows a special bicycle used to break the world speed record for a human-powered bicycle.

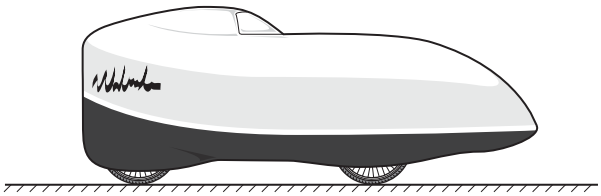


Fig. 3.1

On one run along a measured distance of 200 m, the bicycle's speed is 40 m / s.

(a) Calculate the time taken by the bicycle to travel this distance.

State the formula you use and show your working.

formula

working

time = ... s [2]

(b) The rider travels at a constant speed and then uses the brakes to gradually stop the bicycle.

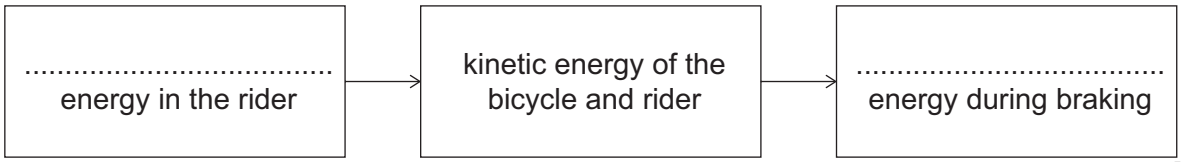
On the axes below, sketch the shape of the speed-time graph for this motion.

[2]

(c) Suggest why the bicycle has the streamlined shape as shown in Fig. 3.1.

..... [1]

(d) Complete the sequence of energy transfers that occurs during the run.



[2]

[Total: 7]

4 **(a)** Fig. 4.1 shows what happens over a few days when a plant is placed near a window where bright light is coming from one side.

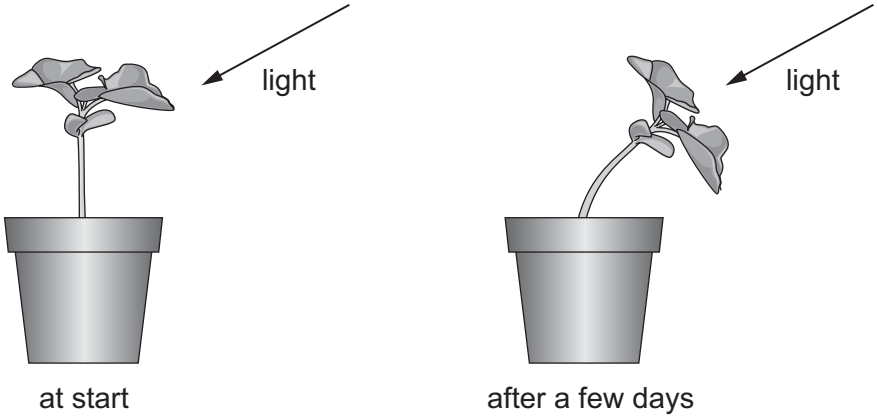


Fig. 4.1

(i) Name the response shown by the plant.

..... [1]

(ii) Explain how the response shown in Fig. 4.1 is an advantage to the plant.

.....

.....

..... [2]

(iii) Name two characteristics of living things shown by the plant in Fig. 4.1.

Explain your answers.

1. characteristic .....

.....

explanation .....

.....

2. characteristic .....

.....

explanation .....

.....

[4]

(b) A student does an experiment to find out more about plant responses. He uses simple shoots and light coming from one side.

The results after a few days are shown in Fig. 4.2.

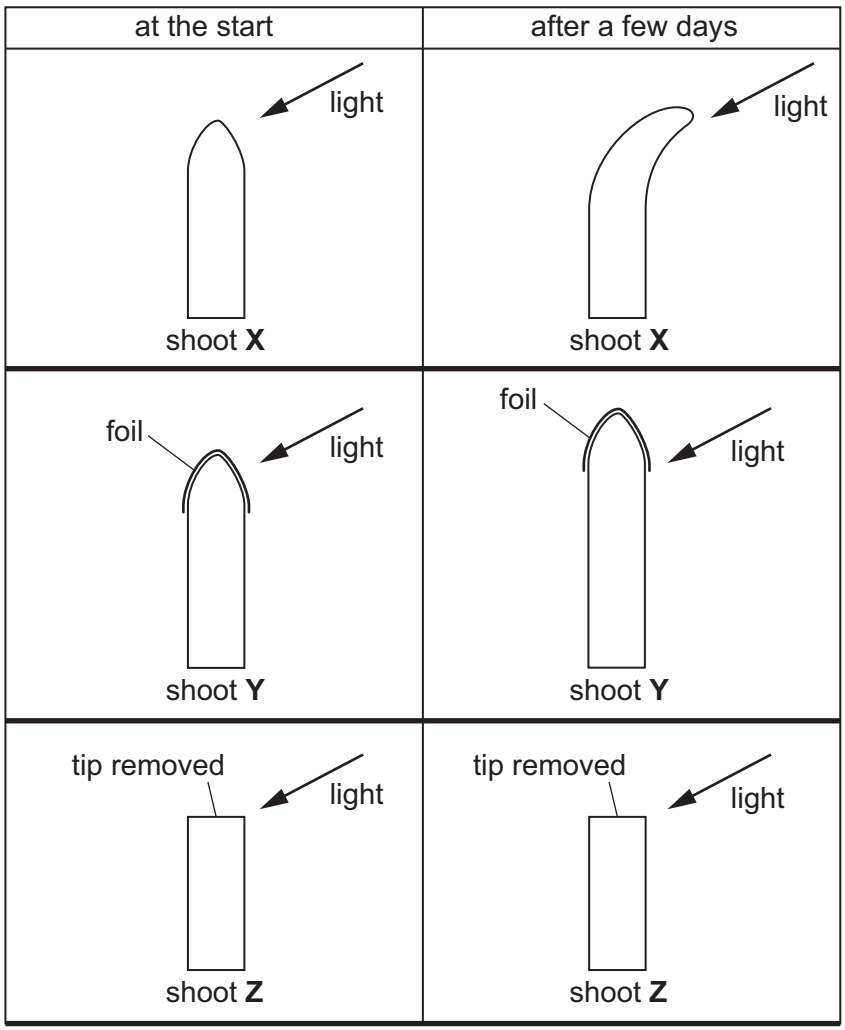


Fig. 4.2

(i) Describe the results for each shoot after a few days shown in Fig. 4.2.

X .....

Y .....

Z .....

[2]

(ii) Suggest a possible conclusion about the control of plant responses in the shoots.

.....

..... [1]

[Total 10]

5 **(a)** Lead metal can be extracted from lead oxide by heating it with carbon.

The word equation for this reaction is shown.

lead oxide + carbon → lead + carbon dioxide

Explain how the equation shows that both oxidation and reduction occur in this reaction.

.....

..... [2]

(b) Another method of extracting lead is by electrolysis.

Before electrolysis, solid lead bromide is heated to form molten lead bromide.

Explain why the lead bromide needs to be molten.

.....

..... [2]

(c) Fig. 5.1 shows the apparatus used for the electrolysis of molten lead(II) bromide.

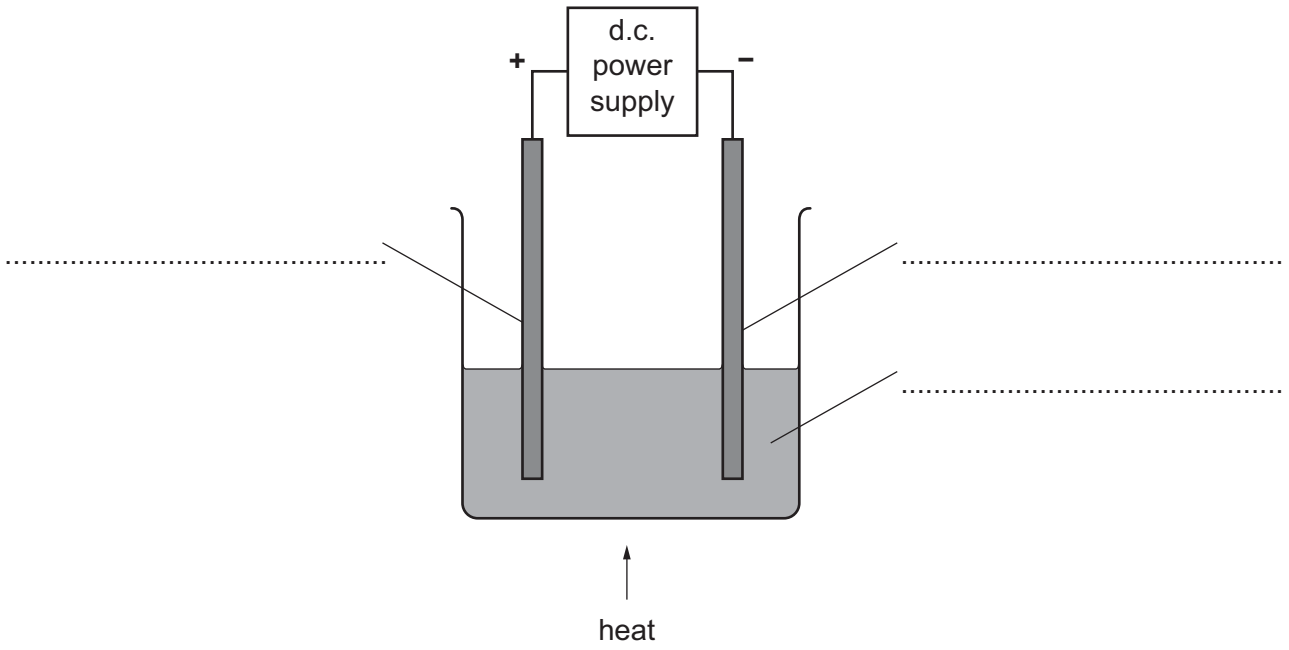


Fig. 5.1

(i) Use the following terms to complete the labels on the diagram in Fig. 5.1.

anode **cathode** **electrolyte** [2]

(ii) Name and describe the appearance of the products that form at

the positive electrode, ...

.....

the negative electrode. .....

.....

[3]

[Total: 9]

6 A man looks at his reflection in a mirror. The tip of his beard is labelled **A**.

This is shown from the side in Fig. 6.1.

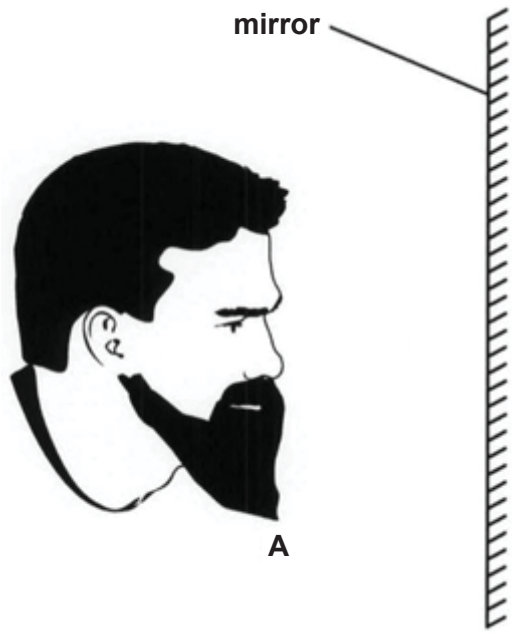


Fig. 6.1

(a) (i) On Fig. 6.1, accurately mark with the letter **X** the position of the image of point **A** in the mirror. [2]

(ii) On Fig. 6.1, draw a ray from point **A** that reflects from the mirror and goes into the man's eye. Use a ruler to draw this ray.

Use arrows to show the direction of the ray. [2]

(iii) On Fig. 6.1, mark the angle of incidence at the mirror using the letter *i*. [1]

(b) Fig. 6.2 represents the regions of the electromagnetic spectrum.

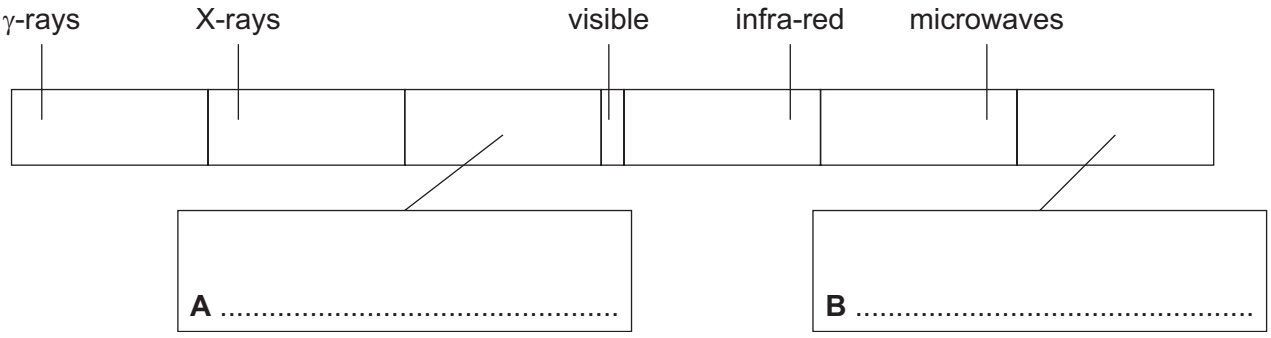


Fig. 6.2

(i) Two of the regions have not been named on Fig. 6.2.

In the two boxes, **A** and **B**, below the spectrum, write the names of these regions. [2]

(ii) On Fig. 6.2, write the letter **S** at the short wavelength end of the electromagnetic spectrum. [1]

(iii) State one use of

infra-red .....

X-rays .....
[2]

[Total: 10]

7 Fig. 7.1 represents the carbon cycle.

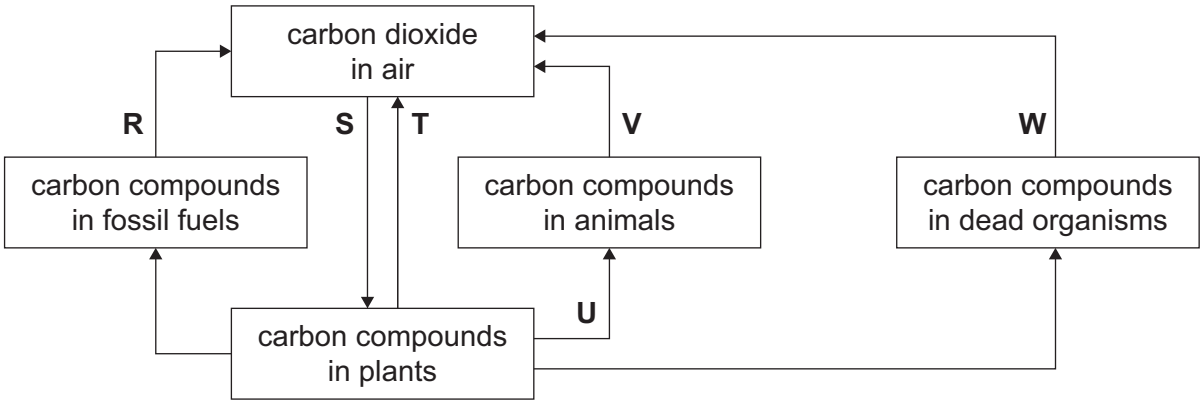


Fig.7.1

(a) Use Fig. 7.1 to answer the following questions.

(i) Name the process labelled **U**.

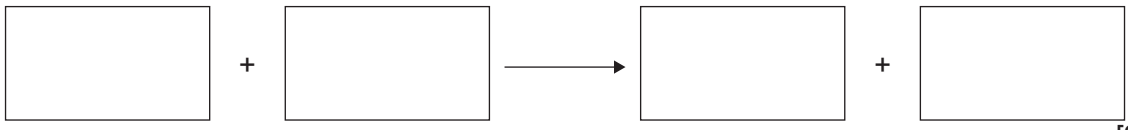
..... [1]

(ii) Name a group of organisms that are responsible for the process labelled **W**.

..... [1]

(b) **(i)** Letters **T** and **V** in Fig. 7.1 both show the process of aerobic respiration.

State the word equation for aerobic respiration.



[2]

(ii) In Fig. 7.1 process **R** is combustion.

Describe two ways in which the process of combustion is different from aerobic respiration.

1. .....

2. .....

[2]

(c) One of the undesirable effects of deforestation is an increase in the carbon dioxide concentration in the air.

List two other undesirable effects of deforestation.

1. .....

2. .....
[2]

[Total: 8]

8 When metal carbonates are heated, carbon dioxide gas is formed.

A student compares the rates of reaction when three different metal carbonates are heated.

She uses the apparatus shown in Fig. 8.1 to measure the volume of carbon dioxide formed.

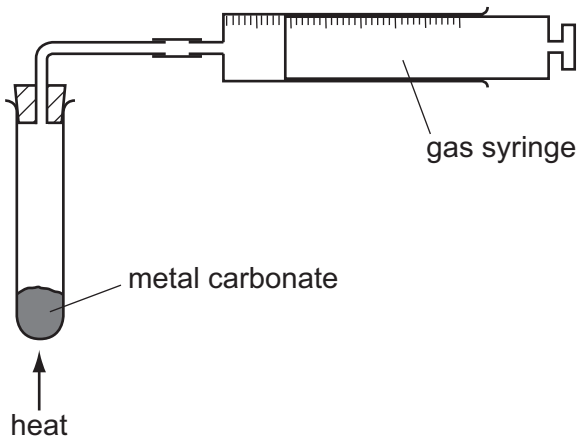


Fig. 8.1

(a) State **one** variable that must be kept constant if the rates of the three reactions are to be compared in a fair way.

..... [1]

(b) The graph in Fig. 8.2 shows how the volume of carbon dioxide changes with time when the three metal carbonates are heated.

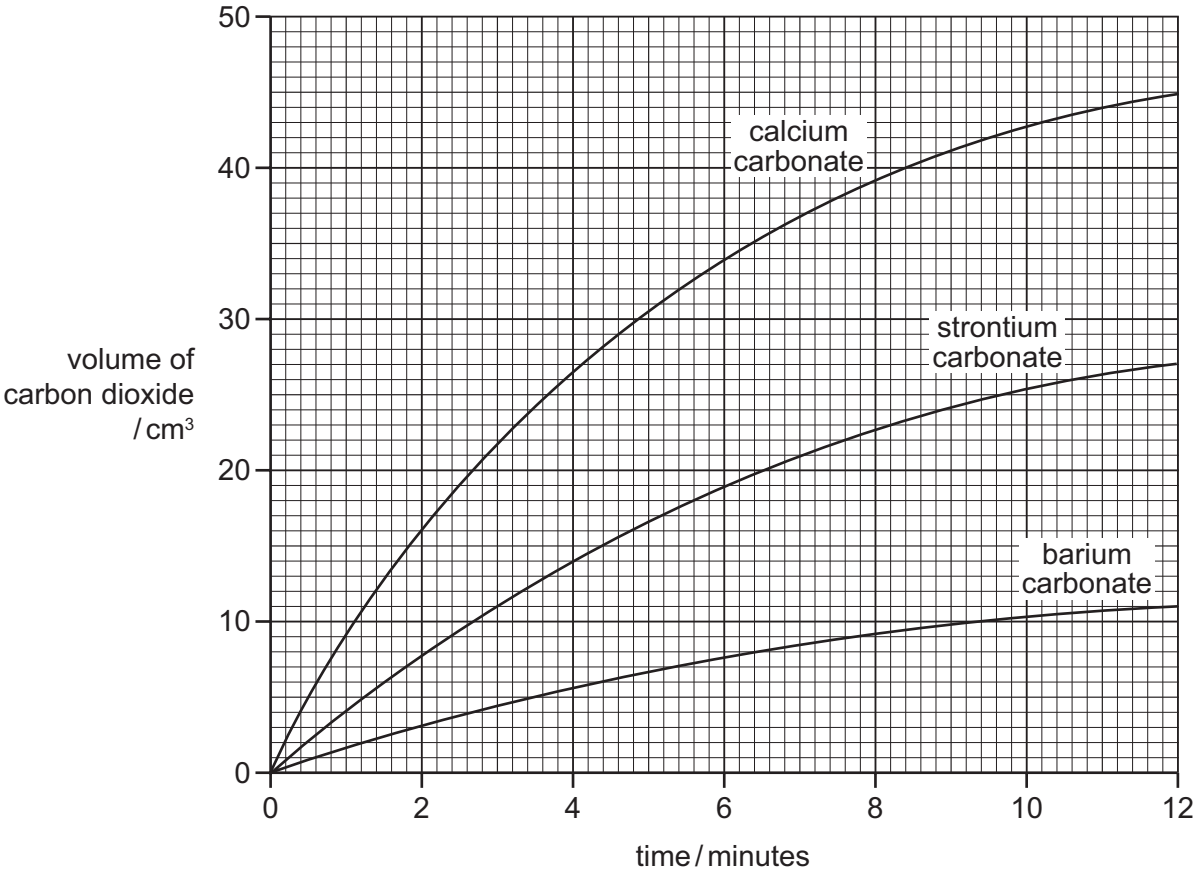


Fig. 8.2

(i) Name the carbonate which forms carbon dioxide at the highest rate.

..... [1]

(ii) Use the graph in Fig. 8.2 to find the volume of carbon dioxide formed by heating strontium carbonate for four minutes.

..... cm^3 [1]

(iii) Calcium, strontium and barium are all in Group II of the Periodic Table.

Use the graph in Fig. 8.2 to describe how the rates of reaction of the metal carbonates change down Group II.

.....

..... [1]

(c) Describe how hydrochloric acid and limewater are used to show that carbonate ions are present in calcium carbonate.

.....

.....

..... [3]

[Total: 7]

[Turn over

9 Fig. 9.1 shows the circuit symbols for an electric bell and a push-switch.

electric bell push-switch

Fig. 9.1

(a) (i) On Fig. 9.2 complete the diagram to show a circuit for a door-bell. The door-bell is powered by a battery with four cells and is operated using a push-switch.

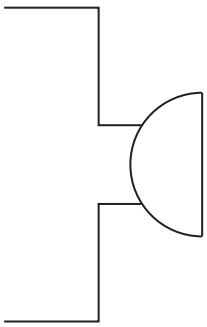


Fig. 9.2 [2]

(ii) On Fig. 9.2, draw a voltmeter to measure the potential difference across the battery. [1]

(b) The ringing bell emits a sound of frequency 400 Hz.

(i) State the meaning of the term *frequency*.

.....

..... [1]

(ii) The house owner makes the sound of the bell louder by adding another cell to the battery. The pitch of the sound from the bell remains unchanged.

State the effect this change has on the amplitude and frequency of the sound emitted.

effect on the amplitude .....

.....

effect on the frequency .....

.....
[2]

(c) (i) The potential difference across the battery is 6.0 V. When the switch is closed, there is a current of 2.0 A in the bell.

Calculate the resistance of the bell.

Show your working and give the unit of your answer.

resistance = ... unit ..... [3]

(ii) The house owner adds an identical bell in parallel with the first bell. When the switch is pushed, both bells ring.

State how this affects the total current in the circuit.

.....

..... [1]

[Total: 10]

The Periodic Table of Elements

Key

atomic number
atomic symbol
name
relative atomic mass

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).